

CASE IN IMAGES

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Immediate implant placement and immediate loading after dental trauma

Jakob Kavčič, Marko Božič

ABSTRACT

Introduction: Traumatic dental injuries represent 5% of all trauma cases where people seek medical assistance. Teeth with a hopeless prognosis can be extracted and immediately replaced with dental implants. Immediate implant placement and immediate loading is a good alternative to a removable interim prosthesis, supports soft tissues, and shortens the time between the first visit and the final prosthetic rehabilitation. **Case Report:** A patient with three severely traumatized teeth in the anterior maxilla is presented. Atraumatic extraction was followed by immediate implants placement and immediate loading with provisional prostheses. The patient was satisfied with the treatment outcome. A good aesthetic and functional result was achieved. **Conclusion:** In complex traumatic dental injuries, immediate implant placement and immediate loading present an acceptable treatment option.

Keywords: Dental trauma, Implants, Immediate implants, Immediate loading

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INTRODUCTION

Traumatic dental injuries (TDIs) of permanent teeth are very common among children and adolescents. Males are more frequently injured due to their risky behavior in permanent dentition. However in primary dentition gender disparities are not so obvious [1]. Most TDIs occur unintentionally with falls, crashes and hits being the most common causes [2]. TDIs represent 5% of all trauma cases where people seek medical assistance and front maxillary area is most frequently traumatized [3, 4]. Aesthetic and functional changes caused by trauma can considerably impact the quality of life of the affected individuals. Psychological embarrassment, problems with social relationships, emotional difficulties, inability to eat properly, and having difficulty with oral hygiene are all proven consequences of dental injury [5]. In primary dentition, luxation injuries are more prevalent whereas in permanent dentition crown fractures are more commonly reported [6, 7]. Treatment of TDIs should be in accordance with International Association of Dental Traumatology guidelines which are evidence based and constantly updated [8]. Minor injuries of the crown involving enamel, dentin or pulp of permanent teeth are usually treated with conservative techniques. Luxation injuries and root fractures are treated with reposition of the tooth and stabilization with a flexible

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splint. Follow-up may include endodontic treatment if pulp necrosis develops. Crown-root fractures can have several treatment scenarios. Treatment scenarios include: fragment removal and gingivectomy (sometimes ostectomy), orthodontic extrusion, surgical extrusion, decoronation and extraction [9]. Extraction is inevitable when teeth are severely damaged. Immediate implant placement (IIP) and immediate loading (IL) is a treatment option in cases of severe TDIs [10, 11]. This approach has several benefits. Firstly it can restore the missing teeth and function without compromising the adjacent teeth [12]. Secondly the patient's missing dental anatomy is immediately replaced which has a positive emotional effect. Thirdly the number of surgical visits decreases [13]. A patient with trauma of the anterior maxilla which was managed with IIP and IL is presented.

CASE REPORT

A 34-year-old woman visited a maxillofacial surgeon for evaluation of the upper anterior region seven days after trauma. Losing consciousness and consequential fall was the cause of injury. The first clinical assessment and treatment were performed at an ENT specialist. Laceration of the mucosal part of the lower lip was sutured. Endodontic treatment of the teeth 11 and 21 was started at a dental office on the same day. Splinting of the injured teeth was not part of the treatment. Systemic antibiotics were also administered during the first aid management. The patient was otherwise healthy, she had no significant personal or family medical history and was a non-smoker. Clinical and radiographic examination revealed a subgingival fracture of tooth 22 with most crown substance being lost (Figures 1, 2). The tooth 21 was extruded, painful, and showed class 3 mobility. Horizontal fracture in the apical third of the root 21 was seen on the local radiograph. The tooth 11 was painful on percussion but firm otherwise. Enamel-dentin fracture with pulp exposure reached half of the crown on the labial side and continued to the gingival margin on the palatal side (Figures 3, 4). The patient received a detailed explanation of the injuries that were present, alternative treatment options and the procedure were explained. Informed consent was obtained to perform extractions of the teeth 21 and 22 followed by immediate implant placement with immediate provisionalization. A conservative approach was first agreed regarding the tooth 11. On the day of surgery 3.4 mL of articaine solution (Ubistesin Forte, 3M Deutschland, GmbH, Neuss, Germany, 40 mg of articaine chloride per 1 mL, 0.012 mg epinephrine per 1 mL) was applied to the vestibular part of the oral mucosa and palatally in the regions 21 and 22 to allow for a painless extraction and implant placement. Marginal incision was performed at the teeth 21 and 22. Minimal mucoperiosteal flap was raised followed by an atraumatic extraction using a luxator and forceps. The extraction socket was then debrided with a diamond burr and irrigated with sterile

saline. The implant sites were prepared at the bottom of the sockets in accordance with the manufacturer guidelines for Astra Tech Implant System (Dentsply, Sweden). Two implants (Astra Tech, Osseospeed TX 3.5 x 15 mm, Dentsply, Sweden) were placed within the confines of the sockets obtaining a good primary stability. Autogenous bone chips harvested during drilling were used as a graft material and added buccally (Figure 5). Temporary abutments (Astra TempDesign, Dentsply, Sweden) were positioned on the implants (Figure 6). The wound was sutured with non-resorbable (Atramat nylon 5.0, Atramat, Mexico) sutures. An IL provisional composite resin crowns were then custom made on the temporary abutments. The provisional crowns were not put into occlusion. The patient was instructed to take 1 g of amoxicillin with clavulanic acid (875mg of amoxicillin/125mg clavulanic acid) every twelve hours five days postoperatively and to rinse twice daily with 0.12 % chlorhexidine solution for two weeks. A soft diet and good oral hygiene was advised. For postoperative pain prevention, non-steroidal-anti-inflammatory drugs were prescribed. Five to seven days of absence from work was also recommended. Control local radiograph showed a good position of the implants but also revealed a horizontal fracture of the apical third of the root 11 which was not seen on the previous radiographs (Figure 7). The same treatment was agreed with the patient and was performed 7 days after the first operation. An implant of the same dimensions was used in the region 11 (Astra Osseospeed TX 3.5 x 15 mm, Dentsply, Sweden) and an immediate provisional crown was custom made. Good position of the implant was seen on the control radiograph (Figure 8). The patient was satisfied with the aesthetic outcome of the temporary restorations (Figure 9). 4 months after the second operation final prosthetic rehabilitation took place and resulted in an excellent functional and aesthetic outcome (Figure 10). Long term follow up is necessary to further evaluate the success rate and the long term aesthetic outcomes of the IIP. Regular follow up with photographic and radiographic imaging on a yearly basis is scheduled for the patient.

DISCUSSION

Facial aesthetics, with eyes and mouth being the most common facial attraction features, play an important psychosocial role in every human life and social interactions [14, 15]. Consequently, dental trauma with tooth loss or severely damaged non-restorable teeth presents a heavy psychological and functional burden for the patient [5]. Patients with finished growth are the potential candidates for treatment with dental implants [13]. The original Brånemark [16] implant placement protocol predicts a two stage surgery. A three to six month healing period then follows. During this time the implant osseointegrates without being exposed to external forces. Disadvantages of this conventional



Figure 1: Clinical photograph showing the preoperative condition of the injured teeth 11, 21 and 22.



Figure 4: Local radiograph showing fracture of roots 21 and 22.



Figure 2: Panoramic radiograph of the affected upper anterior region, central side of the dental arch (teeth 11, 21, 22).



Figure 5: Implants in position.



Figure 3: Local radiograph of the injured teeth.



Figure 6: Temporary abutment placement on inserted implants.

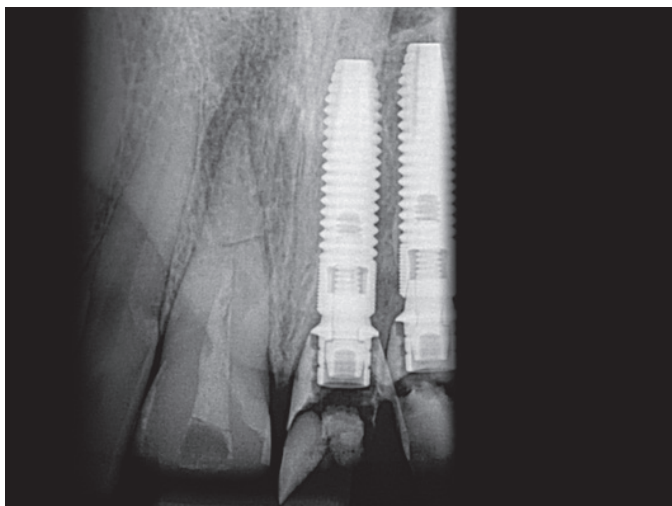


Figure 7: Control local radiograph reveals a horizontal fracture of the apical third of the root 11.

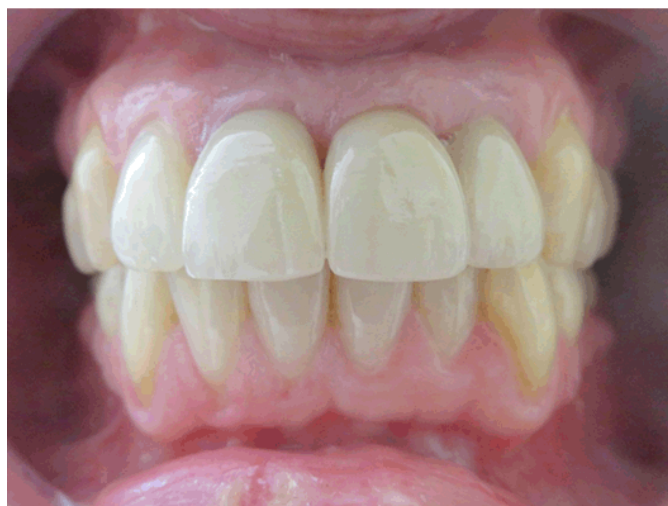


Figure 10: Definitive restorations.



Figure 8: Local radiograph showing implant placement in region 11.



Figure 9: Postoperative condition showing temporary provisional crowns one week after second operation, two weeks after first operation. Image courtesy of Martin Kocjan, DMD, C-dent d.o.o.

treatment are extended treatment time, two surgical interventions, and the need for interim prosthesis during healing [17]. In the presented case the significant delay in prosthetic rehabilitation which follows the conventional implant placement protocol was very inconvenient for our patient who wanted an immediate aesthetic solution. The treatment options and possible outcomes were presented to the patient and the selected treatment was accepted by the patient. The time passed since the injury and the fact that the teeth were not immediately taken care of in accordance to the dental trauma guidelines both contributed to poor prognosis of the teeth and the final treatment selection. Other factors that influenced the patient's decision were the number of visits and financial unpredictability of the treatment alternatives. IIP preserves the alveolar ridge and it decreases the morbidity and rehabilitation time associated with tooth replacement. It also increases patient's satisfaction with the treatment. However, there is no consensus regarding advantages of IIP in the literature. A systematic review by Lang et al. [18] who analyzed 46 prospective studies reported an annual failure rate ranging from 0.5 % to 1.4 %. This evidence puts IIP in a very favorable position. More recently however a systematic review and meta-analysis by Melo CC et al. [19] showed that survival rate of delayed implants (98.38%) was significantly greater than immediate implants (95.21%) ($p = .001$). No significant difference was shown for the marginal bone loss, implant stability quotients values, and pocket probing depth. Despite several advantages, IIP has a higher risk of failure and complications compared to delayed implant placement which should therefore be considered as a primary treatment option where aesthetics are not a concern [20–22]. IL followed IIP in the presented case. There are two types of IL presented in the literature. The first type is when provisional or definitive prosthesis and opposing teeth are in occlusal contact. The second type is to avoid this contact by modifying the provisional

restoration. The purpose of this modification is to reduce the possibility of forces (functional or parafunctional) to cause mechanical overload. The latter approach was also used in our case. However, another systemic review and meta-analysis by Chrcanovic BR et al. [23] concluded that for the survival of dental implants the difference between both approaches might not be that important. Another conclusion by this study was that the difference in marginal bone loss between both approaches is statistically insignificant. Surgery in the anterior maxilla demands a good implantation technique and establishment of optimal hard and soft tissues are very important. Bone resorption occurs after tooth extraction and the reduction in horizontal dimension is greater than in vertical dimension. The consequence of bone resorption is the retraction of the oral mucosa which can compromise aesthetics [24]. When a thin buccal wall is present and an implant is placed close to this wall, the risk of complications such as bone dehiscence and compromised healing is very high [25]. A retrospective study performed by Groenendijk E. et al. [24] showed promising results with a more palatal implant placement in a way that a buccal gap of 2 mm or more was filled with bone substitutes. Creating this buccal gap results in new bone formation coronal to the receding buccal bone wall. However, further research on this topic must be made. Other parameters can also affect the stability of soft tissues. Evans CD and Chen ST [26] concluded that recession was observed at both thin and thick gingival biotypes. However, recession at thin biotypes was of greater magnitude. When patients are selected for IIP it is important that we consider two things: more than 1 mm of labial bone and less than 3 mm distance from the bone to the gingival margin has to be present. A thick gingival biotype and no loss of bone on the labial aspects is preferred [13]. In the presented case bone integrity of the alveolar sockets was preserved. No fracture of the buccal bone was present. Atraumatic extractions left the sockets in perfect condition with buccal bone dimension more than 1 mm, therefore conditions for implantation were favorable. There was no need to use cone beam computed tomography because guided surgery was not planned, there was no risk for injury to vital structures and there was no need to determine the necessity for bone grafting preoperatively. Treatment was adequately planned based on panoramic and local intraoral radiography [27]. Another important factor for successful IIP is achieving a good primary stability which is positively associated with a successful implant integration. In case of IIP primary stability is achieved by anchoring the implant in the apical bony region and is influenced by many factors including local bone quantity and quality, implant macro-design and surgical technique. Implant stability quotient was not used with this case, but a subjective clinical estimate of the implant stability was noted by the treating surgeon and it was excellent [28].

CONCLUSION

In complex TDIs the teeth often cannot be restored. IIP and IL are an esthetically, psychologically, functionally, and biologically acceptable solution for the patient. This treatment modality immediately replaces the missing dental anatomy, decreases the number of surgical visits, and has a positive impact on the patient's well-being. Proper diagnosis, careful patient selection, treatment planning, follow-up, and a good surgical and prosthetic protocol are very important for obtaining a favorable outcome.

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Author Contributions

Jakob Kavčič – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

Marko Božič – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

Guarantor of Submission

The corresponding author is the guarantor of submission.

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Consent Statement

Written informed consent was obtained from the patient for publication of this case in images.

Conflict of Interest

Authors declare no conflict of interest.

Data Availability

All relevant data are within the paper and its Supporting Information files.

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